

Estimating market power in a two-sided market: the case of newspapers*

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April 2006

Abstract

The newspaper industry is a two-sided market: the readers market and the advertising market are closely linked by inter-market network externalities. We estimate market power in the Italian newspaper industry by building a structural model which encompasses a demand estimation for differentiated products on both sides of the market and where profit maximization by the publishing firms takes into account the interaction between them. The question that we address is whether the observed price pattern is consistent with profit-maximizing behavior by competing firms or is instead driven by some form of (tacit or explicit) coordinated practice.

Keywords: *demand estimation, market power, two-sided markets, newspapers, differentiated products.*

JEL codes: L11, L40, L82, C33

*We are grateful to Massimo Motta and Andrea Ichino for advice and comments. We also thank Marc Ivaldi, Bruno Jullien, Jean-Charles Rochet, Fiona Scott Morton, Richard Spady, Elmer Sterken, Frank Vella, Frank Verboven, Reinhilde Veugelers and participants to the CEPR Young Researchers Meeting (Brussels), the Third Workshop on Media Economics, the 2005 ESSET Symposium, the Second CEPR School in Applied Industrial Organisation, the HOC 2005, the EC² Conference 2004, the Conference on Media Regulation (Toulouse), and EUI for useful conversations and suggestions. We are also grateful to the Editor and two anonymous referees for useful comments and suggestions. Part of this work was done while Elena Argentesi was visiting the IDEI in Toulouse within a RTN programme.

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1 Introduction

In the last few years there has been a renewed interest for media markets in economics. With deregulation in the '80s and then globalization in the '90s, we have witnessed a surge in mergers and cross-media ownership, leading to higher media concentration almost everywhere in the world. One of the key issues is the extent to which the various media enjoy market power. The objective of this paper is to propose a framework for measuring market power in media markets (and in two-sided markets in general) with an application to the Italian newspaper industry. A model aiming at studying the structure of competition in the newspaper market must take into account the two-sided nature of this market. Indeed, besides the readers market there is also a market for advertising space, and the two are closely linked by inter-market network externalities. In other words, the willingness to pay of advertisers depends on the size (and sometimes on the composition) of the readership, as well as readers' demand might be a function also of the amount of advertising.

One implication that can be drawn from the growing body of literature on two-sided markets, initiated by Rochet and Tirole (2003, 2005), Caillaud and Jullien (2003) and Armstrong (2005), is that, as pointed out by Evans (2003), in two-sided industries "market definition and market power analyses that focus on a single side will lead to analytical errors". Because of demand interactions between the two sides of the market, the standard markup formula does not hold. In practice, it is usually the case that one side of the market subsidizes the other side, which might end up paying a price below marginal cost. Examples of platforms that do not charge one side are internet portals, commercial televisions, and the free newspapers.

In order to measure market power, it is necessary to compute price-cost margins taking into account the two-sided nature of this market. In this context, estimating price elasticities of demand is only a first step: finding a low elasticity of demand would not be enough to conclude that newspapers publishers enjoy a high degree of market power. In general, the publishers' optimal behavior would depend on four different elasticities: the elasticity of readers' demand with respect to cover price, the elasticity of readers' demand with respect to the quantity of advertising, the elasticity of advertising demand with respect to advertising prices, and the elasticity of advertising demand with respect to newspaper circulation. Therefore in order to understand the price structure in this market and to determine the "true" margins, we have to build an empirical model which encompasses a demand estimation on both sides of the market and where profit maximization by the publishing firms takes into account the interaction between them.

Our econometric model consists of two related demand equations, one for each side of the market, and one condition for profit maximization. We estimate readers' demand under the assumption that it does not depend on advertising quantity. This simplifying assumption is justified in our case by the finding of an econometrically insignificant impact of advertising quantity on readers' demand, which is consistent with previous findings and maintained view in this industry (see Section 3). We therefore focus on a one-way externality, namely the effect of circulation on advertising demand.

We formulate two alternative conjectures, namely that newspaper firms compete in an oligopolistic setting or that firms jointly maximize profits, *in each of the two sides of the market*. This leads to four possible situations: the firms compete on both markets, the firms jointly maximize profits on both markets, the firms jointly maximize profits on the readers' market but compete on the advertising market and, viceversa, the firms compete on the readers' market but jointly maximize profits on the advertising market. After estimating the parameters of the demand functions, we compute the estimated markups under the four alternative hypotheses and then compare them with the observed markup in order to assess which model of competition better explains reality.

We perform this analysis on an original panel dataset which includes data on circulation and advertising for the four biggest national newspapers in Italy from 1976 to 2003. There are two main reasons why one may want to perform an empirical study in this market. The first is that despite the growing body of theoretical literature on competition and pricing in two-sided markets, there is still little work on the empirical implications of these theories, especially for media markets.

Some recent empirical studies on two-sided markets aim at quantifying network externalities and multi-homing in electronic payments system industries (Akerberg and Gowrisankaran, 2003; Rysman, 2004a). Rysman (2004b) builds a two-sided model to estimate network effects in the market for Yellow Pages. In his setting, platforms charge only one side of the market (the advertisers), whereas consumers get the service for free. In our case instead publishers' profits are the sum of advertising profits and profits from circulation.

Closer to our work are two recent papers by Kaiser (2004) and Kaiser and Wright (2006). In the first paper, Kaiser estimates a model for profit maximization on both sides of the market for German women magazines. Kaiser and Wright (2006) estimate an adapted version of Armstrong (2005) model of competition in a two-sided market where magazines compete in a Hotelling fashion and, similarly to Kaiser (2004), the authors find that the readers' market is subsidized by advertising. Neither Kaiser (2004) nor Kaiser and Wright (2006) explicitly address market power issues, which are the focus of our

paper. By comparing the estimated margins with the observed ones, we draw inferences about firms' behavior and the strength of competition in this market.

There is also another reason which makes the Italian newspaper market an interesting case study. Newspaper cover prices were regulated by a governmental agency, and it is only in 1988 that prices were liberalized. Price liberalization does not seem to have had any strong impact on price competition: prices have had a quite stable pattern and price increases by the different newspapers have always been quite simultaneous (see Figure 2). It is therefore interesting in this context to understand what is the pricing policy adopted by newspapers, taking also into account the existence of the related advertising market. In particular, the question that we address is whether the observed pattern in newspaper prices is consistent with profit-maximizing behavior by competing firms or is instead driven by some form of (tacit or explicit) coordinated practice.¹ This is particularly relevant in this case since the previous period of regulation might have facilitated the coordination of pricing strategies across firms.

The next section provides a description of the newspaper market in Italy and an overview of the dataset used in the empirical analysis. Section 3 describes the estimating model. Section 4 discusses the estimation methodology and results and Section 5 concludes.

2 The market of Italian daily newspapers

We use a panel of the four biggest national newspapers in Italy from 1976 to 2003. We restrict our analysis to the national newspapers of general information, i.e. newspapers which are distributed over the whole Italian territory. In several antitrust decisions both in Italy and abroad, this market has usually been seen as distinct both from the market of business newspapers and from that of sport newspapers.² From a demand-side perspective, sport and business newspapers are quite different from the newspapers of general information in terms of the type of information they provide, of the audience they attract, and of the time pattern of demand (sport newspapers, for example, have a much higher circulation on Mondays). On the other hand, the national newspapers of general information seem to belong to a different market than local newspapers, which mainly cover local news and are therefore targeted to a different kind of readership.³

¹It is interesting to know that in 1996 the Italian Antitrust Agency issued a message to the Authority for Communications (which is in charge of supervision on the media industry) drawing the attention to the price parallelism in the newspaper market after liberalization. However, this initiative was not followed by any opening of a formal investigation.

²See for example the case 3354/95 *Ballarino vs. Grandi Quotidiani*.

³This classification is the one which is commonly adopted by Italian and foreign antitrust agencies in newspaper markets. For a discussion on market definition in printed media industries, see also Argentesi and Ivaldi (2005). Our dataset and methodology could in principle be applied to the definition of relevant markets, but such an analysis is

We carry out our analysis on the four main national generalist newspapers which are considered to be substitutes to each other, namely *Corriere della Sera*, *La Repubblica*, *La Stampa* and *Il Giornale*.⁴ Together with *L'Avvenire*, *Il Giorno* and *Il Foglio* (which constitute a small fringe), they belong to the group of national daily newspapers. In 2000 they accounted for more than 90% of the sales of the group, while the group itself accounted for 35% of overall sales of daily newspapers.

The series of monthly average daily printed copies for the four newspapers considered are presented in Figure 1. The two leading ones in terms of circulation are *Repubblica* and *Corriere della Sera*, while *La Stampa* has a lower market share and *Il Giornale* is well below *La Stampa*. It should also be taken into account that *Repubblica* was founded exactly in January 1976. As a result the graph of its average daily sales follows the usual S-shape well-known in the literature on product diffusion. The timing of the spikes which can be observed in Figure 1 in January 1989 for *Corriere della Sera* and in January 1987 for *Repubblica* coincide respectively with *Portfolio* and *Replay*, two games of the lotto kind which could be played only by buying a copy of the newspaper (at the normal price).

A particular feature of the Italian newspaper market has always been the pricing behavior of this industry. For many years the price was regulated, and even after price liberalization nominal price changes have been rare and quite simultaneous across newspapers. As Figure 2 shows, in our sample period the base price is identical and always changed within the same month for all the four newspapers (with one exception for *La Stampa*).

Another remarkable feature of this industry is the considerable amount of non-price competition that has taken place through bundling strategies. Starting from the end of the eighties, the practice of selling supplements and inserts together with newspapers has become increasingly widespread.⁵ In the case of some supplements the reader is forced to buy the supplement if he wants to read the newspaper and thus forced to pay the higher price for the bundle (pure bundling). This is the case of weekly magazines, which are bundled with the newspaper in a particular day of the week. Given that each newspaper issues the weekly magazine in a different day of the week, this practice introduces a source of variability in prices across newspapers and days of the week which, as argued below, can be exploited to identify the price elasticity of demand for daily newspapers in Italy.

Our database on the market for newspapers in Italy mainly draws from data collected from the

beyond the scope of this paper.

⁴It is worth mentioning that the ownership structure in this industry is characterized by the presence of two big groups, *L'espresso* and *RCS*, which own respectively *Repubblica* and *Corriere della Sera*, while *La Stampa* is owned by a group close to *FIAT*, and *Il Giornale* is currently owned by the Berlusconi family.

⁵For an analysis of the impact of weekly supplements on newspaper circulation, see Argentesi (2004).

Accertamenti Diffusione Stampa (ADS), the Federazione Italiana Editori Giornali (FIEG), Audipress, and additional information that we have collected from other sources.⁶ ADS data contain information on newspaper circulation. FIEG collects data on accounting balances of publishing firms, in particular information on revenues from sales and advertising and aggregate costs. Survey data on readers' characteristics for each newspaper are published by Audipress. The database has been completed with other useful information, mainly obtained from newspaper publishers, such as the nominal prices of the newspapers, the dates regular supplements were introduced, the list of all promotions with the corresponding periods, the changes of editors, and the dates of the opening of the newspapers websites. See Section 4 for a description of the variables used in the econometric analysis.

3 A supply and demand model

In this section we develop a model that captures the interaction between the two sides of the market, namely the readers and the advertisers. In particular, we formulate two demand models, one for the readers' side and one for the advertising side. On the supply side, newspaper publishers are assumed to maximize their profits on both markets. We derive the pricing equation under two alternative assumptions, namely that the market is oligopolistically competitive and that firms jointly maximize their profits. In the next section, based on estimates of the models, we compare the estimated margins with a crude measure of observed margins in order to determine which model is the closest to reality.⁷ This allows us to explore the issue of market power.

3.1 The demand side

In order to estimate the demand on the two sides of the market, we use two logit models of product differentiation. Notwithstanding their restrictive assumptions on the patterns of substitution, these models are widely used for their computational simplicity or when the implied restrictions on price elasticities are not considered crucial. An alternative model is the full random coefficients or mixed logit (e.g. Berry & al, 1995; Nevo, 2001), which is more general and allows substitution between products to depend on product characteristics through observable consumers demographics.

⁶We are grateful to Sibilla Guzzetti of ADS, Laura Ferrari of Audipress, Elena Olivetti of Assocarta, Ferdinando Aldè of Media Consultants, and Giovanni Mastrogiacomo of *La Stampa* for kindly providing us with the data. The data of ADS, Audipress and FIEG are publicly accessible, but only recent years are available on electronic support (see the websites www.adsnotizie.it, www.audipress.it, www.fieg.it).

⁷This strategy has been used for market power estimation when data on price-cost margins were available, see Nevo (2001).

In our case the higher computational burden of estimating a full random coefficients model does not seem to be justified, since we restrict our analysis to a group of substantially similar products and there appears to be no strong case for differentiation of taste parameters on the basis of readers characteristics (see Table 1). Being aware of the possible bias in assuming that substitution takes place on the basis of market shares, we run a simulation exercise to check whether our conclusions are robust to errors in the estimations of the elasticities (see Section 4).

3.1.1 Newspaper demand

We assume that readers' demand is independent of advertising. This assumption is based on three considerations. Firstly, we have tried several specifications with advertising quantity as an explanatory variable for readers' demand (properly instrumented), but the corresponding coefficient was never significantly different from zero.⁸ Secondly, we believe that this is a plausible approximation of reality since readers may have opposite perceptions of advertising depending on the content (informative or persuasive), and advertising on newspapers can be skipped more easily than in other media (see also Gabszewicz et al., 2002 and 2004). Finally, allowing for readers' demand to depend on ad quantity would create a circularity that has implications on the solvability of the theoretical model.

In order to estimate readers' demand, we make use of a nested logit model. This model allows consumer tastes to be correlated across products (which is not the case for the simple logit model), by grouping products according to some observable characteristics which are expected to make them closer substitutes for consumers. In our case, it seems reasonable to assume that the outside good (buying no national newspaper at all) constitutes one nest, whereas the four newspapers considered belong to the other nest. This amounts to assuming that the reader's choice is twofold: first, she chooses whether to buy a national newspaper or not, then which one to buy among those available on the market. This implies that, for given market shares, consumers substitute more toward other national newspapers than toward the outside good (which includes other types of newspapers as well).

Consumers are assumed to purchase one unit of the newspaper that gives them the highest utility. This assumption seems reasonable in the case of newspapers, since multiple purchases are likely to be negligible, and since subscriptions and corporate buys of newspapers (which are typically multiple

⁸This result is also consistent with Rosse (1970)'s findings on the newspapers market. This may not be the case for other printed media: see for example Kaiser and Wright (2006), who find that in the magazine market readers display an ad-loving attitude (which is plausible, since in this type of publications ads are usually more targeted than in newspapers of general information).

purchases) are very low in Italy. The demand equation for the nested logit model is:⁹

$$\ln(s_{it}) - \ln(s_{0t}) = \mathbf{x}_{it}\boldsymbol{\beta} + \alpha p_{it} + \xi_{it} + \sigma \ln(s_{it|g}) \quad (1)$$

where s_{it} is the market share of newspaper i at time t , $s_{0t} = 1 - \sum_i s_{it}$ is the market share of the outside good, \mathbf{x}_{it} and ξ_{it} denote observed and unobserved characteristics respectively, p_{it} is cover price, and $s_{it|g}$ is the share of newspaper i within group g . The market shares s_{it} are defined over the total potential market size, which is considered to be the total population in Italy older than 14 years, as it is usual in studies on the media market. The within market shares $s_{it|g}$ are instead defined over the total of the four newspapers considered in the analysis. The parameter $\sigma \in [0, 1)$ measures the correlation of utility within each group (if σ tends to 1 newspapers within a group are perfect substitutes, whereas if σ is equal to 0 they are independent and we are in the simple logit case). The dependent variable is therefore the (log) market share of newspaper i at time t relative to the (log) market share of the outside good.

Given the panel structure of the data, the unobservable component ξ_{it} can be decomposed as

$$\xi_{it} = \gamma_i + \varepsilon_{it} \quad (2)$$

where γ_i is a fixed product-specific component correlated with \mathbf{x}_{it} and ε_{it} is an i.i.d. error term varying across newspapers and time.

3.1.2 Advertising demand

We adopt a simple logit specification for advertising demand. The assumptions behind the logit model might be stronger in this context than they are in the context of readers' demand. In particular the assumption of single purchase could be more problematic when referred to the purchase of advertising space than when it refers to readers' choice, because there might be advertisers who buy slots in more than one newspaper (multi-homing). We also tried alternative specifications for advertising demand, but the limited number of observations on the advertising side did not allow us to estimate the many more parameters that multi-homing would require. In the absence of data on the amount of multi-homing by advertisers, we rely on anecdotal evidence to give support to our assumption. We recorded all the advertising messages on three consecutive issues (1st, 2nd, and 3rd of December 2005) of the four

⁹For a derivation of the demand equation from the random utility model for the nested logit, see Berry (1994).

newspapers of our sample. In each day of the week, more than 84% of advertisers put an advertising message in only one of the four newspapers, and only 10% in two of them. This evidence seems to give support to the assumption that multi-homing is not a widespread practice, at least at the most disaggregated unit of time.¹⁰

Adopting a logit specification for the demand of advertising slots, the estimating equation for the advertising market is:

$$\ln(s_{it}^A) - \ln(s_{0t}^A) = \mathbf{x}_{it}^A \boldsymbol{\beta}^A - \alpha^A p_{it}^A + \xi_{it}^A + \rho y_{it}^N \quad (3)$$

where s_{it}^A is the number of advertising slots of newspaper i at time t relative to the total potential market size, p_{it}^A is the advertising price, \mathbf{x}_{it}^A and ξ_{it}^A are the observed and unobserved characteristics respectively (i.e. the characteristics of the newspaper which may affect advertising demand). Total potential market size for advertising is defined as the market of daily publications. The model takes into account the fact that the demand of advertising space depends positively on the circulation of the newspaper (y_{it}^N), which in turn depends on the vector of newspaper prices.

3.2 The supply side

We assume that newspapers set prices simultaneously in both sides of the market. We consider two different scenarios, one in which the industry is oligopolistically competitive, and one in which it is collusive (joint profit maximization). We derive the pricing equations and the corresponding formulae for the markups under the two hypotheses. In this way we obtain four possible markups: one corresponding to a situation of oligopolistic competition in both markets, one for joint profit maximization in both markets, and two for the intermediate cases (competition on the newspaper market and joint profit maximization in the advertising market; competition on the advertising market and joint profit maximization in the newspaper market).

3.2.1 Oligopolistic competition

We derive the pricing equation under the hypothesis that newspapers are competing à la Bertrand-Nash. Since the newspapers offered are differentiated, we are in a framework of oligopolistic competition.

¹⁰ For an explicit modelling of multi-homing, see for example Kaiser and Wright (2006) and Doganoglu and Wright (2006).

The profit function of each newspaper i is¹¹

$$\pi_i(p_i^A, p_i^N) = p_i^N y_i^N(\mathbf{p}^N) + p_i^A y_i^A(\mathbf{p}^A, \mathbf{y}^N(\mathbf{p}^N)) - c_i^N y_i^N(\cdot) - c_i^A y_i^A(\cdot) - F_i \quad (4)$$

where p_i^N is the price of newspaper i , y_i^N is its demand, which depends on the vector of newspapers prices \mathbf{p}^N . As to advertising revenues, p_i^A is the price of an advertising slot on newspaper i , and y_i^A is the corresponding demand, which depends on the vector of advertising prices \mathbf{p}^A and on the vector of readers' demands (which themselves depend on newspaper prices). Under the assumption of constant marginal costs, c_i^N and c_i^A are the marginal cost of the newspaper and the marginal cost of advertising respectively, while F_i is a generic fixed cost.

Each firm chooses the cover price and the advertising price which maximize profits, taking other firms' behavior as given. For each newspaper i , there are two first-order conditions (FOC), one which determines the pricing equation for advertising and one which determines the pricing equation for the newspaper:

FOC(p^A) The maximization with respect to p_i^A gives the following condition for the advertising markup:

$$p_i^A - c_i^A = -\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} \quad (5)$$

FOC(p^N) The FOC with respect to p_i^N is different because it incorporates the fact that the choice of the price of a newspaper has an impact not only on the readership, but also on advertising revenues.

The maximization with respect to p_i^N gives therefore ($\forall i, j$):

$$p_i^N - c_i^N = -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A) \frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}} \sum_{j \neq i} \frac{\partial y_i^A}{\partial y_j^N} \frac{\partial y_j^N}{\partial p_i^N} \quad (6)$$

Notice that the price-cost margin is lower than in the standard case exactly because of the inter-market network effect: a change in cover price has a negative effect on advertising revenues. This network effect is represented by the last two terms in the right-hand side of equation (6). The first of these terms expresses the fact that a price increase decreases own readership and therefore decreases own advertising demand. The last term represents the effect through competitors: a

¹¹In what follows, we omit the t subscript to simplify notation.

price increase for newspaper i increases the readership of rival newspapers, and has a negative effect on its advertising demand through a positive impact on rivals' advertising demand.

The markups can then be computed on the basis of the demand parameters of the estimated logit models.

3.2.2 Joint profit maximization

Suppose that firms collude, so that each firm i chooses the prices which maximize joint profits:

$$\Pi(p_i^A, p_i^N) = \sum_i [p_i^N y_i^N(\mathbf{p}^N) + p_i^A y_i^A(\mathbf{p}^A, \mathbf{y}^N(\mathbf{p}^N)) - c_i^N y_i^N(\cdot) - c_i^A y_i^A(\cdot) - F_i] \quad (7)$$

As in the case of competition, we derive the FOCs for each of the two prices.

FOC(p^A)

$$p_i^A - c_i^A = -\frac{y_i^A}{\frac{\partial y_i^A}{\partial p_i^A}} - \sum_{j \neq i} \frac{(p_j^A - c_j^A) \frac{\partial y_j^A}{\partial p_i^A}}{\frac{\partial y_i^A}{\partial p_i^A}} \quad (8)$$

The additional term on the right-hand side of equation (8) represents the fact that under collusion, firm i takes into account the impact that its decisions have on other firms' profits, and therefore the price it sets is higher than the one under competition.

FOC(p^N) The maximization with respect to p^N gives instead:

$$\begin{aligned} p_i^N - c_i^N = & -\frac{y_i^N}{\frac{\partial y_i^N}{\partial p_i^N}} - (p_i^A - c_i^A) \frac{\partial y_i^A}{\partial y_i^N} - \frac{(p_i^A - c_i^A)}{\frac{\partial y_i^N}{\partial p_i^N}} \sum_{j \neq i} \frac{\partial y_j^A}{\partial y_j^N} \frac{\partial y_j^N}{\partial p_i^N} + \\ & - \sum_{j \neq i} \left[\frac{(p_j^N - c_j^N) \frac{\partial y_j^N}{\partial p_i^N}}{\frac{\partial y_i^N}{\partial p_i^N}} + \frac{(p_j^A - c_j^A)}{\frac{\partial y_i^N}{\partial p_i^N}} \sum_k \frac{\partial y_j^A}{\partial y_k^N} \frac{\partial y_k^N}{\partial p_i^N} \right] \end{aligned} \quad (9)$$

This expression differs from (6) by the last term, which represents the higher markup due to joint profit maximization. Notice that also this last effect is mitigated by the existence of a link with the other side of the market, and therefore the markup is lower than in the standard collusive case.

4 Empirical results

On the basis of the models described above, we estimate by two-stage least squares two distinct demand equations, one for the advertising market and one for the readers' market. We do not estimate the two

equations simultaneously because both the frequency of the data and the time period they cover are different.

We then insert the estimated parameters (together with the observed quantities) in the markup formulae in order to compute four different price-cost margins under the alternative hypotheses of competition and collusion in each of the two markets. Finally, we compare the average of these estimated margins with the average observed margin in order to assess which model is closer to reality.

We discuss the estimation results for the two markets in the next two subsections. In the last subsection we then compare the estimated markups with the observed markups and derive implications for market structure.

4.1 Readers' demand

On the readers' side, we estimate the nested logit model of demand defined by equation (1) using a panel on the average daily number of copies printed in each day of the week of each month for *Repubblica*, *Il Corriere della Sera*, *La Stampa*, and *Il Giornale* from 1976 to 2001 (for example, the daily average prints on Mondays of July 1990). Given that our panel has a long time dimension, we use real prices rather than nominal prices. Real prices change through time because of both nominal price changes (see Figure 2) and of inflation (prices are deflated by the monthly Italian CPI). Although there is little variation across newspapers in the base nominal price, there is nominal price variation across newspapers due to the presence of supplements (which are bundled to the newspaper at a higher price in different days of the week). The same newspaper has therefore a different nominal price across the days of the week. In addition, since the day of the week in which supplements are issued differs across newspapers, price varies also across newspapers in a given day. We exploit this source of variation in the data to identify the price parameter, under the assumption that the quality of the supplement does not change through time. Descriptive statistics on real cover prices are provided in Table 1.

The vector of product characteristics (the vector \mathbf{x}_{it} in equation (1)) includes dummies for the issue of the weekly magazines that are sold together with the newspaper (both a dummy for the day of the week of issue and a general dummy for their presence), dummies for the presence of a website, for games with prizes played on the newspaper and for changes of editors. We also include the number of local sections for each newspaper and monthly dummies to capture seasonality in the data. See Table 1 for descriptive statistics on these variables.

Using a newspaper-day-of-the-week fixed effect rather than a simple newspaper fixed effect allows

us to control for unobserved characteristics of each newspaper which vary by day of the week and allows for a different ranking of newspapers across days of the week. Notice that the vector of fixed effects ξ_i is identified separately from the coefficients on characteristics because in our framework the latter are time-variant (see Berry, 1994 p. 256).

Market shares within group are endogenous by definition and need to be instrumented. Also the price might be endogenous, although there is limited variation in nominal prices across newspapers, and we therefore instrument for it too. We use the sum of the characteristics of other firms as instruments (in particular we use the number of women supplements, the number of supplements of general information and the number of games), as it is common in the literature on discrete-choice models of product differentiation (see for example Berry, 1994; Nevo, 2000; Ivaldi and Verboven, 2005). These are appropriate instruments because they are correlated with the price and with the within market shares through the condition for profit maximization, but are exogenous to the single firm decision.

The estimation results for readers' demand are presented in Table 2.

The price coefficient is negative and significant at a 1% significance level. Estimated own-price elasticities are around 0.75 (see Table 4).¹² Cross-price elasticities are estimated in a range from 0.11 (*Corriere della Sera*) to 0.04 (*Il Giornale*).

The other coefficients have the expected sign and are very precisely estimated. The coefficient for the day of issue of the magazine of general information is positive. The fact that the coefficient of the dummy for the introduction of the magazine of general information is positive and significant suggests that the supplements had an impact not only on the day of the week in which they are issued, but also on the other days, which can be seen as a spillover effect. Our estimates show that also lottery games have been very successful. Another interesting result concerns the launch of websites, which seems to have had a negative impact on printed newspapers.¹³

Tests of the instrument validity are presented in Table 2. The Anderson canonical correlations likelihood-ratio test rejects the null of underidentification at the 1% significance level, while the Hansen-J test does not reject the null hypothesis that the instruments are valid, even at the 10% significance level. In the first-stage regressions (not reported for the sake of brevity), the F-statistics of significance of the instruments are significant at the 1% level.

¹²Notice that in our two-sided framework the finding of an elasticity below one is not at odds with a profit-maximizing behavior, precisely because of the additional negative term in the markup due to the inter-market network effect.

¹³See Filistrucchi (2005) for the analysis of the impact of Internet on traditional newspapers on the same dataset that we use here. For a different finding in the German magazine market, see Kaiser (2003) and Kaiser and Kongsted (2005).

Testing for autocorrelation in the residuals using Wooldridge (2002) test for panel data yields an $F(1,27)$ -value of 100.9, thus rejecting the null hypothesis of no autocorrelation at a 1% significance level. A simple regression of the average of the residuals for each month on its twelve lags seems to suggest that autocorrelation is of order one as at a 5% significance level it is not possible to reject the hypothesis that the coefficients on the lags from 2 to 12 are jointly equal to zero (the $F(11, 287)$ -statistic is 1.81). We therefore compute standard errors consistent with autocorrelation of order one. One simple explanation for such autocorrelation is that in this market shocks to demand are news and news might take place in more than one period.

4.2 Advertising demand

On the advertising side we estimate a logit model of demand on a panel of average daily slots in each year from 1992 to 2003 for the four newspapers, according to equation (3). As explanatory variables for advertising demand we include newspaper's prints, the readers' average age, the share of male readers and the difference between the own real advertising price and the average advertising price across all daily newspapers not included in our sample, which correspond to our outside good.

In order to perform the estimation, we need information on the advertising price and on advertising quantity for each newspaper. Regarding advertising prices, we have list prices per advertising slot for each of the four newspapers considered. We are aware of the limitations of using price list data in a field where discounts are a common practice, but this was the only information we managed to obtain from a private source. Moreover, what matters for the sake of the present analysis is that the potential bias between list prices and actual prices does not differ too much across newspapers and over time, which seems a plausible assumption.

Since we do not have information on advertising quantity but only on advertising revenues, yearly average advertising volumes are computed by dividing advertising revenues by advertising prices for each newspaper. This assumes that advertising discounts, if any, are a percentage of the price.

Table 1 contains descriptive statistics on the advertising variables.

Both newspaper circulation and advertising prices are endogenous. Advertising prices are a choice variable, while the size of the readership is endogenous in the advertising demand equation because firms simultaneously choose cover prices and advertising prices. Again we use the sum of the characteristics of other firms as instruments, in particular the sum of the average readers' age and the sum of the proportion of male readers. In addition we use as an instrument the number of free copies

distributed by each newspaper (which can be seen as a cost of attracting advertising and therefore correlated with advertising price).

Results of this estimation are shown in Table 3. The price parameter is negative and significant at 1% significance level. Estimated own- and cross-price elasticities are reported in Table 4. Estimated own-price elasticities are in a range from 0.91 (*Repubblica*) to 0.33 (*Il Giornale*). Cross-price elasticities are estimated in a range from 0.007 (*Repubblica*) to 0.001 (*Il Giornale*).

The coefficient of newspaper circulation is positive, confirming the externality with the readers market. The demand for advertising space seems to depend negatively on readers' age and on the share of male readers.

In Table 3 we also present tests on the validity of the instruments. The Wu-Hausman tests show that newspaper circulation and advertising prices are endogenous at the 5% and 10% significance level respectively. The Anderson canonical correlations likelihood-ratio test rejects the null of underidentification at the 1% significance level, while the Sargan test does not reject the null hypothesis that the instruments are valid, even at the 10% significance level. In the first-stage regressions, the F-statistics of joint significance of the instruments are significant at the 1% level. Testing for autocorrelation in the residuals using Durbin (1970) test yields a small sample F(5,30)-value of 3.82, thus accepting the null hypothesis of no autocorrelation at a 5% significance level.

4.3 From markups to market structure

In order to estimate the markups, the parameters of interest are those related to the price elasticities of readers' demand and advertising demand, respectively α_N in equation (1) and α_A in equation (3), as well as that related to the elasticity of advertising demand with respect to circulation (the parameter ρ in equation (3)), which measures the network effect.

Results for the estimated markups are reported in Table 5. These markups are averages across newspapers (weighted by prints) and over time from 1997 to 2001. We report both the average cover price markup and the average advertising price markup under the four alternative hypotheses on firms' behavior in the two markets. The total markup per copy is the sum of the two markups (where the advertising markup has been transformed in per copy rather than per advertising slot). Notice that there are only two relevant markups for advertising prices (one for the competitive case and one for the collusive case) because advertising markups do not depend on cover price given our assumption of a single externality. We have instead four relevant cover price markups because these markups depend

on the advertising market.

An interesting feature of the estimated markups is that, given our observed quantities, estimated total markups under joint profit maximization in the advertising market are lower than those with oligopolistic competition ($0.425 < 0.430$ and $0.792 < 0.797$). This feature is another consequence of the two-sided nature of this market. In the Appendix we derive the condition under which this situation may arise. This condition, as we discuss below, is always satisfied in our case.

Let us stress that the finding of negative markups on cover prices in two of the four cases of Table 5 is a possible feature of a two-sided market and implies that under these market structures there would be cross-subsidization from advertising to circulation (see Kaiser and Wright, 2006, for a similar result).

For each of these estimated average markups we calculate the standard errors by bootstrap. We draw with replacement 1000 samples from the observed data. On the readers' side the bootstrapped samples have the same number of observations as the original data used in the estimation. However the size of the bootstrapped samples on the advertising side is bigger than that of the original sample. As the variable "prints" appears both as an (instrumented) explanatory variable on the advertising side and, after a transformation, as the dependent variable on the readers' side, we need to ensure that the standard errors take into account the correlation among estimated demand parameters on the two sides. We thus link the two datasets by year and newspaper and each time draw data for both sides.¹⁴ It is important to note that in this way the probability of each advertising side observation being drawn does not change. On each bootstrapped sample we estimate the relevant demand parameters and insert them inside the markups formulae. We take the standard deviation of the 1000 bootstrapped markups as the standard error of the corresponding estimated markup.

From the data collected from balance sheets, we compute the (average) total markup per copy for the four newspaper that we are considering, which is 0.943 Euro (with a standard deviation of 0.101).¹⁵ In particular this value is obtained by subtracting from the average revenue per copy (for the four newspapers under consideration) the average cost per copy (for the class of daily newspapers with a circulation above 200,000, in which all ours are), excluding from the average cost the accounting fixed costs plus the costs of labor and other services, thereby leaving mainly costs of materials (in

¹⁴For example, if we draw the observation "Corriere della Sera on the average Friday of July 1988", we include for all variables that observation in the readers' side sample and the observation "Corriere della Sera in 1988" for the advertisers' side sample.

¹⁵A value of markup (both estimated and observed) of about 0.9 Euro might seem too high for a newspaper whose cover price is around 0.9. However, it should be taken into account that these values are total markups per copy, i.e. the sum of the markups per copy on the cover price and on the advertising price.

order to obtain a measure of average variable costs). Since it is not possible from newspapers budgets to distinguish between costs of newspapers and costs of advertising, we can only compute the average total observed markup.

We compare this observed markup with the estimated ones in order to assess which model of competition better fits reality. Comparing averages across newspapers and time is meaningful since their standard deviation is relatively small (about 0.07 for each of the four markups). Moreover, averaging across newspapers is necessary because, as explained above, we do not have sufficiently disaggregated data to calculate the observed markups for each newspaper. Note also that comparing averages is sufficient for the purpose of the present paper because we do not aim to explain the price dynamics but rather the price level.

For the reason explained above, in the advertising market joint profit maximization is dominated by competition. Indeed, although very small, the differences between the estimated markups in the two cases is statistically significant, whatever the firms behavior in the readers' market. The differences in the estimated markups between the two cases of competition and collusion in advertising are about 0.006. From the bootstrapped markups we calculate the bootstrapped differences and take their standard deviations, which are both about 0.0001. As a result a large sample test based on a $N(0,1)$ leads in both cases to the rejection of the null hypothesis of equality of the estimated markups at 1% significance level. Economically, the differences, albeit small, are not irrelevant, because they imply annual differences in profits of about 1,320,000 Euro (1.4%) and 1,250,000 Euro (0.7%) respectively.

Given that in the advertising market joint profit maximization is dominated by competition, the two relevant estimated markups are the first one (competition in both markets) and the third one (joint profit maximization in the newspaper market and competition in the advertising market) in Table 5. Statistical evidence in favor of the model collusion-competition is strong. In particular, the average markup in the case competition-competition is 0.430 with a bootstrapped standard error of 0.091, whereas the one for collusion-competition is 0.797 with a standard error of 0.188. The two 95% confidence intervals (based on a normal distribution) are therefore [0.252, 0.608] and [0.428, 1.166] respectively. The observed markup of 0.943 falls within the confidence interval of the estimated markup that firms would obtain if they were jointly maximizing profits in the newspaper market, whereas it falls out of the confidence interval of the estimated markup under competition in the newspaper market. Therefore the hypothesis that there exists some collusion is not rejected by the data, whereas the one that firms are competing in both markets is. This seems to be consistent with the observed pattern of

cover prices. On the other hand, the advertising market seems to be much more competitive. Indeed, advertising prices are subject to a lot of discounting and are not easily observable by competitors, a factor which probably makes collusion more difficult to sustain.

Being aware of the known restrictive assumptions that the logit model places on estimates of price elasticities, we ran a simulation exercise to check the robustness of our conclusions to idiosyncratic changes to both the own- and cross-price elasticities of newspaper demand and the own- and cross-price elasticities of advertising demand. In order to do this, for each element in the matrices of price elasticities we draw 10,000 random changes of up to 15% (in absolute value) of the originally estimated values. For each draw we recompute an estimate of the markups. Results are reported in Table 6. For each draw the estimated markup for the case competition-competition is always farther away from the observed one than the collusion-competition one. In addition using the previously bootstrapped standard errors and building a 95% confidence interval around any of the 10,000 simulated values for the markups always leads to rejecting the hypothesis of competition-competition and accepting the one of collusion-competition. This can be seen by building a confidence interval from a normal distribution around the maximum simulated value of the markup competition-competition and the minimum simulated value of the markup collusion-competition, as reported in Table 7. Statistical evidence in favor of the model collusion-competition is therefore robust to idiosyncratic changes of up to 15% of the estimated price elasticities.

5 Conclusions

We address the issue of measuring market power in a two-sided market with an application to the Italian newspaper market. Using an original dataset on Italian newspapers, we estimate the demand on the two sides of this market, the readers' side and the advertising side. We also model the supply side and derive the hypothetical markups under two alternative conjectures about newspapers' behavior for each of the two markets, namely a competitive behavior and a collusive behavior. The comparison between the estimated markups and the observed markups shows some evidence of joint profit maximization on the newspaper cover price, whereas the advertising market is closer to competition, a finding which is consistent with anecdotal evidence.

The Italian newspaper industry is an interesting field of application for our analytical framework since there has been a change in the regulatory regime, switching from a system where cover prices were regulated to a system of price liberalization. The interesting feature is that prices display parallelism

and stickiness even in the period after liberalization. This pattern of prices suggests the possibility that the previous regulatory period determined the persistence of a focal point for tacit collusion.¹⁶ In other words, the presence of a previous system where prices were fixed for all newspapers by a regulatory agency which did not change them very often may have facilitated coordination on a price-setting behavior consistent with the previous practice. Our findings indeed show that the hypothesis of collusive price setting cannot be rejected by the data, confirming the impression that price liberalization has not led to a truly competitive regime.

Of course, other forms of non-price competition may partly compensate for the weak competition on cover prices. As we have discussed, competition through supplements seems to have played a key role in this industry. Moreover, given the two-sided nature of this market, competition on cover prices is only one part of the story, the other important element being competition in advertising. In this respect, our results suggest that there is competition on advertising prices among newspapers (which might also be due to the competitive constraints from other media), which mitigates the stronger market power that they enjoy on the readers' side.

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¹⁶Knittel and Stango (2003) find evidence that price regulation (in the form of price ceilings) may serve as a focal point for tacit collusion in the credit card market.

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Appendix: Comparison of markups

We saw above that, given the observed prices and quantities, joint profit maximization in the advertising market gives a lower estimated (total) markup than oligopolistic competition. This is possible because, as in Nevo (2001), we do not solve the first-order condition for the optimal quantities as a function of parameters but rather insert the observed quantities in the markup formulae derived from the first-order condition (because, under the assumption of profit maximizing firms, these are the optimal ones).

Consider the case of competition in the readers' market and compare the total markup under the two alternative hypotheses of competition and collusion on the advertising market, for a given level of prices and quantities. Advertising prices would be higher if firms were colluding in the advertising market than if they were competing. Advertising quantity would therefore tend to be lower. In order to keep advertising quantity unaltered, the firm can increase the readership by lowering the cover price, which implies a lower cover price markup. If the lower cover price markup more than offsets the higher advertising price markup (with respect to the case of competition), then the total markup under collusion in advertising is lower than the total markup under competition (in advertising).

In order to derive the condition under which in the advertising market collusion yields higher profits than competition, we compare the markup obtained in the case where there is competition in the readers' market and collusion in the advertising market with the markup obtained under competition in both markets, for given prices and quantities. It is easy to show that the same condition applies when firms collude in the readers' market.

The total markup in the case where firms compete in the readers' market but collude in the advertising market is the sum of the competitive markup on cover price (equation (6)) and the collusive markup on advertising prices (equation (8)), the latter transformed in per copy terms by multiplying by y_i^A/y_i^N .

The total markup when firms compete in both markets is the sum of the competitive markup on cover price (equation (6)) and the competitive markup on advertising prices (equation (5)), the latter multiplied by y_i^A/y_i^N .

Comparing these two markups, after some simplifications, we get the following condition which tells us when the markup under collusion is higher than the markup under competition:

$$\left| \frac{p_i^N}{y_i^A} \sum_j \frac{\partial y_i^A}{\partial y_j^N} \frac{\partial y_j^N}{\partial p_i^N} \right| < \left| \frac{\partial y_i^N}{\partial p_i^N} \frac{p_i^N}{y_i^N} \right| \quad (10)$$

The intuition for this condition is that if the network effect is relatively high (the left-hand side is the aggregate elasticity of y_i^A with respect to p_i^N), joint profit maximization in the advertising market gives a lower markup than competition in the advertising market, because it implies lowering a lot the cover price markup. On the other hand if readers' demand elasticity is relatively high, it is worthwhile sacrificing the relatively low cover price markup to the advantage of advertising markup by colluding in the advertising market.

Tables and figures

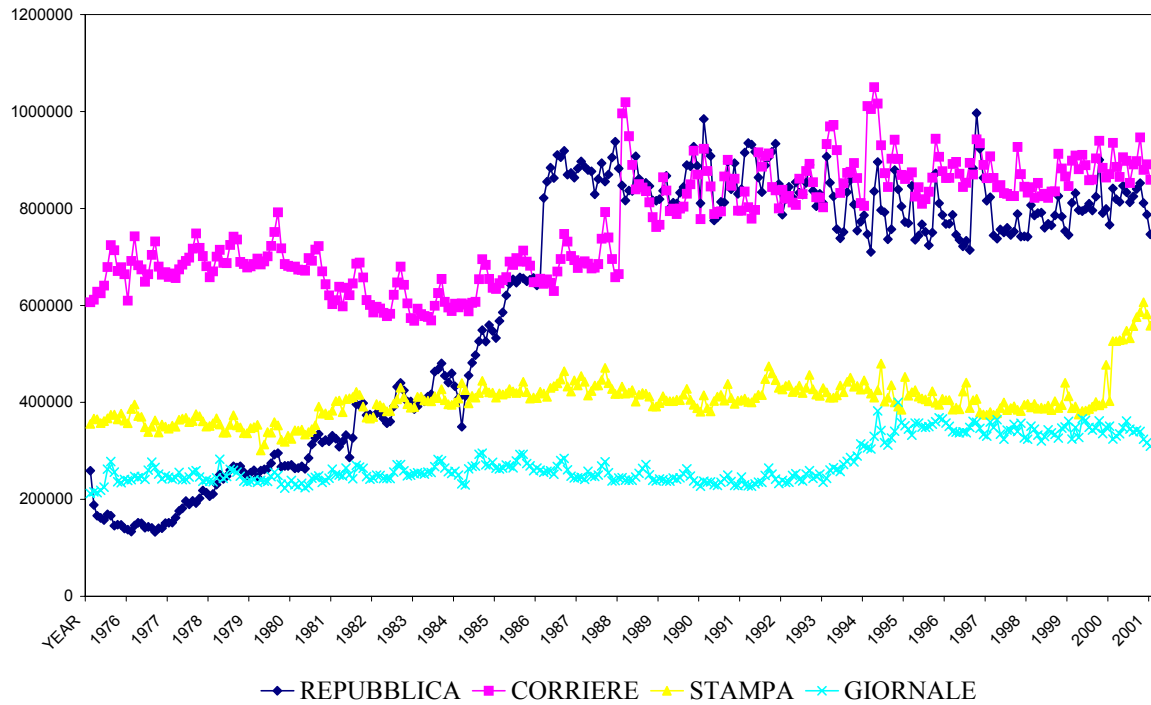


Figure 1: Monthly averages of daily printed copies

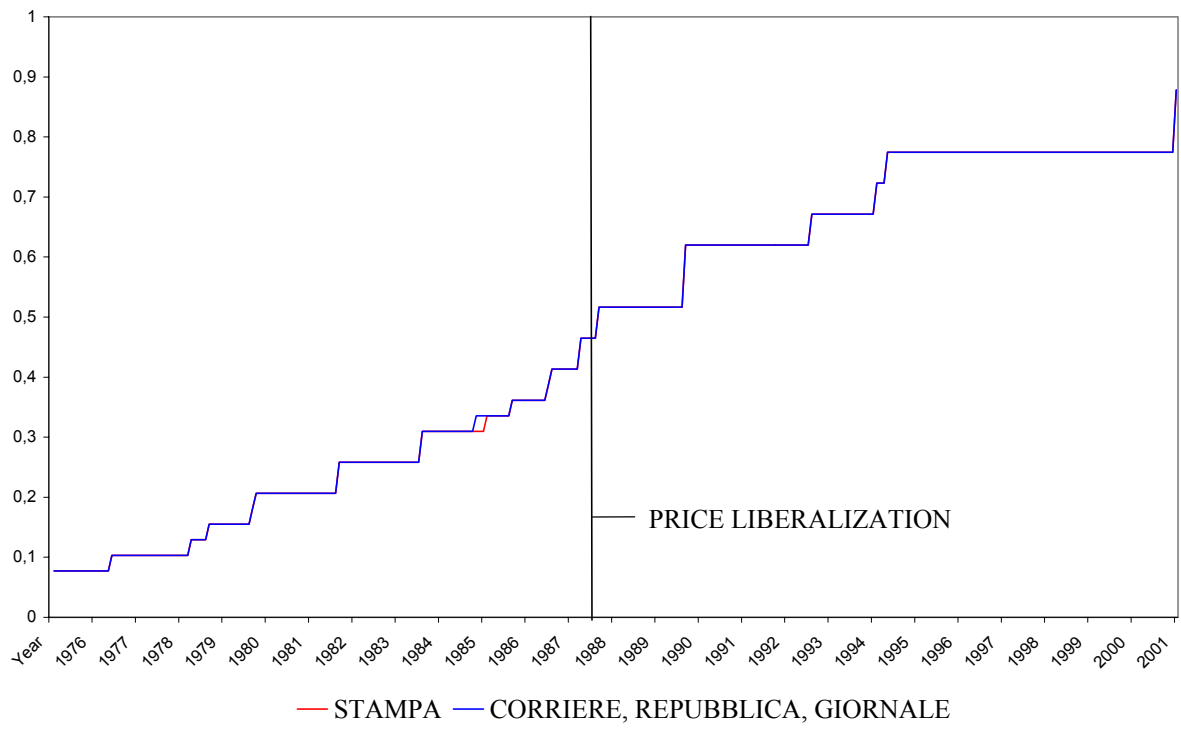


Figure 2: Newspapers' cover prices (in Euro) without supplements

Table 1: Descriptive statistics

	Mean	St. Dev.	Min	Max
Readers' demand				
Market shares	.012	.005	.003	.026
Real cover price	.649	.140	.397	1.255
Generalist magazine	.332	.471	0	1
Generalist magazine (day)	.049	.215	0	1
Women magazine	.115	.319	0	1
Women magazine (day)	.016	.127	0	1
Games	.066	.249	0	1
Website	.164	.370	0	1
Local pages	5.043	5.574	0	31
Advertising demand				
Market shares	.005	.003	.001	.012
Real advertising price	.613	.220	.207	.890
Newspaper's prints ($\times 10000$)	62.834	22.275	23.882	93.288
% male readers	59.347	2.173	53.5	64.9
Readers' age	37.939	2.380	32.184	43.278
Gift copies	6086.409	3162.324	2194	12020

Note: Market shares for readers' demand are computed with respect to the total potential market for readers (population above the age of 14). Market shares for advertising demand are computed with respect to the total potential market for advertising (total quantity of advertising for all the daily newspapers in Italy). Cover prices are in Euro and advertising prices in thousands Euro. The number of observations is 8424 for readers' demand and 44 for advertising demand.

Table 2: Readers' demand

	Nested logit fixed effect	
	Coeff.	Std. err.
Real cover price	-.858**	.270
Generalist magazine	.350**	.050
Generalist magazine (day)	.353**	.086
Women magazine	.036*	.017
Women magazine (day)	.264**	.085
Games	.197**	.022
Website	-.065**	.019
Local pages	.018**	.002
σ	.322**	.073
Time trend	.006**	.001
Time trend squared ($\times 1000$)	.013**	.001
Constant	-3.551**	.088
N. of obs.	8424	
	Coeff.	p-value
Anderson's LR stat.	71.180	0.000
Hansen-J stat.	.368	.544

Note: The dependent variable is log market shares of prints minus log market shares of the outside good (see equation (1)). "***" denotes significance at 1% level and "*" denotes significance at 10% level. Newspaper-day of the week fixed effects are included in the regression, as well as dummies for changes in editors and month dummies. Sums of characteristics of the other newspapers (supplements and games) are used as instruments for prices and within market shares. Identification/IV relevance test: Anderson canonical correlation likelihood ratio statistic. Overidentification test of all instruments: Hansen-J statistic.

Table 3: Advertising demand

	Coeff.	Std. err.
Real advertising price	-1.195**	.324
Newspaper's prints	.022**	.004
% male readers	-.052**	.011
Readers' age	-.110**	.016
Constant	1.137	.716
N. of obs	44	
	Coeff.	p-value
Wu-Hausman F test for Adv. prices	3.313	.077
Wu-Hausman F test for Prints	2.102	.155
Anderson canon. corr. LR stat.	14.144	.001
Sargan stat.	.467	.494

Note: The dependent variable is log market shares of advertising minus log market shares of the outside good (see equation (3)). Instrumental variables: sum of the other newspapers' characteristics (average age and % of male readers) and number of free copies. “**” denotes significance at 1% level. Identification/IV relevance test: Anderson canonical correlation likelihood ratio statistic. Overidentification test of all instruments: Sargan statistic.

Table 4: Own and cross demand price elasticities

	Readers' demand		Advertising demand	
	Own	Cross	Own	Cross
<i>Corriere</i>	-.726 (.176)	.108 (.027)	-.874 (.077)	.006 (.001)
<i>Repubblica</i>	-.758 (.163)	.086 (.040)	-.913 (.121)	.007 (.001)
<i>Stampa</i>	-.738 (.164)	.071 (.014)	-.815 (.163)	.002 (.000)
<i>Giornale</i>	-.764 (.127)	.037 (.006)	-.331 (.063)	.001 (.000)

Note: Standard deviations are in parentheses.

Table 5: Estimated markups

	Cover price markup	Advertising markup	Total markup
Comp(N)-Comp(A)	-.272	.702	.430 (.091)
Comp(N)-Coll(A)	-.288	.712	.425 (.091)
Coll(N)-Comp(A)	.095	.702	.797 (.188)
Coll(N)-Coll(A)	.079	.712	.792 (.188)

Note: Markups (in Euro) are average across newspapers for the period 1997-2001. “Comp (N)-Coll(A)” indicates the case where the newspaper market is competitive and the advertising market is collusive, and similarly for the other cases. Bootstrapped standard errors for the total markup are in parentheses.

Table 6: Robustness check: simulated total markups

	Obs.	Mean	Std. Dev.	Min	Max
Comp(N)-Comp(A)	10000	.434	.050	.272	.602
Coll(N)-Comp(A)	10000	.824	.086	.571	1.117

Table 7: Robustness check: test on simulated markups

	Coeff.	Std. Err.	95% Confidence interval (Normal distribution)	
Max Comp(N)-Comp(A)	.602	.091	.424	.780
Min Coll(N)-Comp(A)	.571	.188	.280	.947